Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

of the sub-order which exhibit the true sectorial tooth of the upper series, as it exists in the Carnivora, and the genus Didymictis has the dental formula of Canis above. Miacis has the formula of Canis below, but that of the superior series is unknown. It would not be surprising if it should turn out to be that of Amphicyon. These animals are abundant in the Middle and Lower Eocenes of North America.

——:o:——

"THE PLAINS" OF MICHIGAN.

BY PROFESSOR V. M. SPALDING.

IN the northern central portion of the lower peninsula of Michigan there extend through several counties large tracts designated on some of the maps as "barrens," but uniformly spoken of as "the plains" by people living upon them or in their vicinity. One of these tracts, perhaps the most extensive, lies along the line of the Mackinaw division of the Michigan Central railroad and occupies a large portion of Crawford county, extending into the adjacent counties on the east side and south, and including an area of over a thousand square miles. A similar, though somewhat less extensive, region of barrens or plains is intersected by the Flint and Pere Marquette railroad, having its center in Lake county, extending southward into Newaygo and northward as far as the Manistee river. Similar plains, of greater or less extent, are to be found in this part of the State and in the northern peninsula, but the two tracts already mentioned may be taken as fair repretatives.

These plains lie in what is known as the "pine belt" of Michigan, and include the poorest portions of this extensive region. Their soil is a light sand, so fine that it penetrates one's shoes as he walks over it, and when a handful is closely examined it is seen to consist almost wholly of fine grains of silica, " good to make glass of," as is remarked by those of the inhabitants who do not believe in its agricultural capabilities. Nevertheless, these plains are by no means a desert. They support quite a variety of vegetable life, and one experiences no feeling of loneliness as he travels over them. On the contrary, wherever they have escaped the destructive action of fire, the smooth, gently undulating ground, with its groves of scrub pine, through which the eye has an extended range in every direction, produces a pleasing impression and we are constantly half-inclined to the delusion that we are walking through an artificial grove, and that just over the knoll or beyond the hollow the buildings of the proprietor will be seen. This is, however, a most unsubstantial feeling and cannot be trusted in the least, for one may wander about for miles without coming upon any trace of human life except the wagon track he is following and occasional blazes on the trees that indicate the path followed by hunters and land-lookers who have gone before him. Indeed there is sometimes real danger of losing one's way, unless he is something of a woodsman, and accounts are not wanting of those who have been lost and have perished from fatigue and hunger on these barrens.

The thing that attracts the attention at the outset and continues to do so, until its constant repetition ceases to produce the impression of anything unusual, is the fact that a large portion of this region has been swept over time and again by fire. Here the fire has passed over within a year, and remnants of the blackened stems of young trees and shrubs that had sprung up after some earlier fire are still standing and the ground itself is bare and blackened. There the conflagration took place a few years ago, and the ground is thickly covered with a new growth several feet in height, the path of the fire being indicated by the tall, charred trunks of larger trees that overtop as complete a picture of desolation as can well be imagined. In the midst of this ruined territory, and often extending for considerable distances, are groves and even good-sized forests, that in some way have escaped destruction and still remain, waiting the equally certain fate of the lumberman's axe or another fire.

The trees that cover a large portion of the plains are scrub pines (*Pinus banksiana*), universally called "Jack pine" by the people, and designated as "Spruce pine" in the notes of Government surveyors. It is not, when it attains its full development, a "straggling shrub or low tree," but often rises to the height of fifty or sixty feet and is really a shapely tree, fit for telegraph poles and like uses if only its wood were less subject to decay. Made into fences it lasts only a few years, and by common consent it is left unused, except for fuel, enjoying the distinction of being considered the most miserable production of this miserable soil. Its great abundance constantly suggests the query as to what it is good for. If the manufacturers of wood pulp can succeed in utilizing it they will find an almost unlimited supply on the barrens of northern Michigan.

Among the scrub pines, and still more in the openings where they are less numerous, oak grubs are distributed far and wide, sometimes rather thinly, as is the case on the lightest sand, while in other places, and generally on the western barrens of the State, they stand more closely together and their rapidly growing sprouts are fast becoming a new forest. There is a story among the Indians living in Lake county that the plains were formerly covered with a forest of oak and pine (presumably white and red pine), but not far from the beginning of the present century a great wind swept over them, prostrating the oaks and leaving the pines, after which a fire destroyed them both, and Jack pines grew up in their place. Whatever significance may or may not be attached to this account, it is certain that the young oaks that are now growing so rapidly on the plains have come from stumps of old trees and not from acorns. The stumps are hardly ever to be seen at the surface, but upon removing a little of the earth or mold from the midst of the group of young trees they are found, often in a fair state of preservation, and of such dimensions as to show that a fair-sized oak tree formerly stood on the spot. The prevailing species are the white and black oaks (*Quercus alba* and *Q. tinctoria*), though in certain localities the red oak (*Q. rubra*) is of common occurrence. Many of these are six to eight or even ten feet high, and, over wide areas, are thick enough together to constitute a perfect forest. In a few years these oaks, if protected from the ravages of fire and the browsing of domestic animals, would furnish a considerable amount of valuable timber. Even now such as have escaped these accidents and have grown to a suitable size are eagerly sought after by mechanics for parts of wagons and like uses, and lumbermen go long distances to get them for pieces of timber. A proper oversight of these young forests, that are already planted and far on their way to useful dimensions, would well repay the State or other owners of the land, although the oak trees that largely compose them cannot be expected to attain very large dimensions on lands of such inferior quality.

Next to the scrub pine and oaks, two kinds of poplar are the most common trees on the plains. They are the quaking aspen (*Populus tremuloides*), and the large-toothed aspen (*P. grandidentata*). In low places they cover the ground, and often on higher land are even more abundant than the pines and oaks. Like them, too, they are making an exceedingly rapid growth, and in a very few years after a fire they have covered the ground with a new forest and are stretching upwards with marvelous haste, as if to cover in the shortest possible time the blackened deformity of the charred remains about them. Like the scrub pine they are waiting for the demands of some great industry to turn their immense growth of material to profitable account.

Besides the scrub pines, oaks and poplars, which constitute the most prominent and almost universal arboreal feature of the plains, various other trees and shrubs are scattered here and there. The wild cherry, both black and red, the choke-cherry and sand-cherry are all here, and the prairie willow (*Salix humilis*), is always to be found, though seldom very thickly distributed. Sweet-fern (*Comptonia asplenifolia*), and brakes (*Pteris aquilina*), grow in great abundance over the entire region, and with them, spread like a carpet over the sands, are the bear-berry and winter-green and trailing arbutus, all uniting, by the extension of roots and decay of stems and leaves, in the grand effort made by nature to reclaim the soil. Then, as if to relieve the monotony of this constant and rather somber background, there are thrown in patches of bright bluebells, the wild orange-red lily, here and there a hawkweed or Solidago, or the bright umbels of a stray pleurisy-root, and, once in a while, one of the rarer northern plants, such as the three-toothed cinquefoil, serving to keep the traveler, if he happens to be a botanist, on a constant and expectant lookout for something new.

The species that have been mentioned by no means complete the list, but they serve to show what are the constant and characteristic features of the vegetation of the plains. Although very many more species will be found in a "flora" of these regions, one is constantly impressed with the uniformity and lack of variety which characterize their vegetable productions. With all of Nature's most persistent efforts to clothe the barest places of earth with a living mantle, it has been found, apparently, that only certain kinds of plants can be made to do duty on these barren spots, and, accordingly, those have been chosen that flourish in places the most uncongenial and hopeless.

Two most valuable species have been reserved for special mention, partly because they do not strictly belong to the plains, at least in the narrower sense of the term. Over considerable portions of their surface it is impossible to find a single white or even " Norway" pine, but wherever the soil changes from the light sand already described to one containing a slight admixture of gravel or loam, and often even when no such change is distinctly obvious, the scrub pine is replaced by the red or " Norway" pine (*Pinus resinosa*). With this, or scattered through hardwood timber, and indicating a soil still somewhat further improved in quality, is the white pine (*Pinus strobus*). Both of these are distributed in tracts of greater or less extent through the plains, but attain a larger development on the better lands beyond them. It is these two species that have given their great value to the pine lands of Michigan, and for the last quarter of a century have furnished such immense quantities of lumber to the markets of the world. Their rapid destruction, with no attempt on the part of any one to replace them or to provide for a future supply, is looked upon with alarm by those who take an intelligent interest in the financial prosperity of the State. It has become a question of immediate and pressing importance, what can be done with these large areas that have already been stripped of their most valuable timber and, abandoned by their owners, are now run over by fires from year to year that exhaust the soil of what little fertility it may have had and leave the whole region a blackened scene of desolation.

The "pine belt," within which these lands lie, is bounded nearly enough for practical purposes by the 43d parallel of latitude on the south and the 45th on the north. As a whole, it is by no means the worthless region that it is still quite generally regarded, but contains extensive areas of hardwood lands, valuable for farming purposes, that are passing into the hands of settlers whose crops of wheat and oats and fruits of various kinds rival those of the older and more favored portions of the State. The future of these better parts of the pine region is already determined. The well-fenced farms, with good buildings and beautiful fields of grain, that are already found in the very midst of a region that a few years ago was reported to be " one great swamp," are a sufficient guaranty that these lands will be permanently and profitably devoted to agricultural purposes. Whether or not this may be less profitable to the State at large than the continued production of timber will not affect the case.

When there are lands of such value for farming they will be purchased and held for this purpose and the interests of the State will in the end have to be adapted to those of the individual.

But however excellent certain portions of the pine belt may be for grain and fruit raising, the fact remains that there are some hundreds of thousands of acres, including the plains already described and considerable areas beyond them, that, so far as present evidence goes, are utterly worthless for agricultural purposes. It is with the future of these sandy plains and deserted and burned pine "slashings" that we are now concerned. A scanty population has already taken possession of certain portions of this territory, and here and there attempts have been made at its cultivation. The settlers have turned over, or dragged over, the light sand and have put in here a piece of rye and there a few potatoes and have attempted in other places to get a field covered with clover or timothy. The results attained are by no means satisfactory. Rye, their best crop, is thin and light. Potatoes are small and few in a hill. A really good piece of wheat or oats was not seen in a journey of forty miles through the plains, and, with perhaps one or two exceptions, the same is true of grass and clover. Whatever may develop, in the future, it is perfectly safe to say that as yet the agricultural capabilities of these plains are not apparent.

In many instances the lands that have been sold to individuals or to corporations, after having been stripped of their pine, revert to the State through failure on the part of their owners to keep up the taxes, this failure manifestly resulting from a belief on their part that after the timber is removed the land is not worth the taxes. This result has hitherto been considered unfortunate, from the fact that the State government is obliged to assume the responsibility and expense of ownership, and the law has recently been changed so as to more fully protect individual purchasers of tax titles, largely for the purpose of relieving the State of this burden. In addition to this the attention of the public is called to these and other lands in the possession of the State by a pamphlet issued by the Commissioner of Immigration (a work, by the way, full of valuable information), and the three principal railroad companies whose lines intersect this portion of the lower peninsula are offering special inducements to purchasers of land. As a result, the current is now setting strongly in the opposite direction and sales of land lying within the pine belt for farming purposes are constantly made. The sales at the State Land Office alone, according to information given at the office at Lansing, have averaged about twenty thousand to twenty-five thousand acres per month during the summer of 1882.

But whatever present advantages may be gained by this rapid transfer from the possession of the State and the railroad companies to that of individuals, a careful study of the facts of the case inevitably leads to the conclusion that undue inducements for the purchase and settlement of lands that cannot sustain a permanent population are greatly to be regretted. It may yet be found, it is true, that the plains are capable of sustaining such a population by the products of the soil. Some crop, yet untried, may flourish there, or some method of fertilization may transform them into fruitful fields, but, from all that is known of the conditions of successful agriculture, there is no reason to expect such a future for them.

There is one way, however, and at present there seems to be but one way, in which these and other waste lands in the same part of the State may be made permanently remunerative. They may be made to produce forests of valuable timber and a product of this sort, judging from the present demand, is likely to be worth many times as much as thin crops of grain that might be gathered from the soil during the entire period of its growth. From what has been stated already it is evident that, however unpromising the outlook may be for the growth of other vegetation, the plains are capable of producing several valuable kinds of timber trees, while the better lands around them have produced one of the finest natural forests that ever clothed the earth.

Over a large portion of this extensive region there is every reason to believe that the policy now pursued in the State of Maine, according to the forestry bulletins of the last census, of "cutting only the large trees and carefully protecting the remainder," would give at intervals a very profitable growth of pine and other timber, and it is to be earnestly hoped that before many years such a system may be inaugurated in Michigan. It will require a radical change from the present wasteful method of cutting everything that can profitably be turned into lumber and then leaving the ground to the destructive action of fire, but it is entirely practicable when once both State and people have come to realize its necessity and the profits to be derived from such a system. Still, in order to attain the best results, by which is meant the greatest return of timber in the shortest time, it will be found necessary, over much of this territory, to resort to planting. This is especially true of the plains where most of the species now growing cannot be expected to yield a timber product nearly as valuable as would be derived from the planting of other and better kinds of trees. As soon, therefore, as any serious attempt is made to rehabilitate the denuded pine regions of the State, it will be necessary to know what species can be successfully grown there that will, at the same time, produce most rapidly, and with a minimum of expense, the most profitable returns. At present very few sources of information upon this important practical part of the subject are available. With the exception of what has been done on the grounds of the State Agricultural College at Lansing, no provision has been made for determining by actual trial what species are most available for planting, and conclusions based upon the results of experiments there may prove entirely misleading when applied to regions situated from one to two degrees farther north, with widely different conditions not only of climate but also of soil.

In carrying out a purpose to gather all the information now to be obtained on this subject, a visit was made by the writer, in the summer of 1882, to the experimental plantations of Messrs. Douglass & Sons, on the beach sands of Lake Michigan, near Waukegan, Ill. At this place the climatic conditions are decidedly less favorable than those prevailing over a large part of the lower peninsula of Michigan, the burning heat of summer and the severe cold of winter reach greater extremes, and the soil is of the poorest quality, yet, under these most unfavorable conditions, a young forest of valuable timber trees has been created and, under the intelligent management of the proprietors, there is every reason to expect most favorable results from the experiment.[1]

The trees that have been planted most extensively are the white pine, Scotch pine, European larch, hardy Catalpa and Austrian pine. A few other kinds have been planted but without satisfactory results further than to prove that they are not adapted to the situation. The Scotch and white pines have made a healthy growth and, though in many cases when set out they were

---

[1] I take this opportunity to acknowledge the courtesy of Messrs. Douglass & Son, and the information kindly given me while at their nurseries last summer.

"culls" unfit for sale, they are developing into fair-shaped, vigorous trees. The European larch, though frequently blistered by the intense heat reflected from the bare sands, when once started makes a vigorous growth, and the Catalpa, which has been tried, however, only two or three years, appears to be entirely hardy and to make a rapid and healthy growth. The Austrian pine often becomes diseased and is evidently inferior to either of the other pines for planting in such a situation. These plantations have been made only for the last eight years, but the results, thus far, are in the highest degree encouraging.

Without attempting to draw conclusions that perhaps can be fully established only after the continuance of such experiments for a quarter of a century or more, it seems safe to gather the following suggestions for our own guidance from the experiments at Waukegan :

1. The species to be particularly recommended for cultivation on the pine barrens of Michigan are the white pine, Scotch pine, European larch and Western Catalpa (*Catalpa speciosa*). Every one of these grows rapidly and produces excellent timber on land of the most inferior quality and in regions exposed to great vicissitudes of temperature.

2. Many kinds of trees, otherwise valuable, will not thrive under these unfavorable conditions, and it will prove a waste of time and money to plant them. The white ash and black walnut, for example, two of our best timber trees, require a better soil; the black cherry will grow, but, like the oak, will not attain full size on such light sand, and still others, such as the Ailanthus, that has elsewhere proven a useful species for cultivation, is not sufficiently hardy for our higher latitudes.

3. To obtain satisfactory results, planting rather than sowing, will have to be practiced. Sowing seeds on the burning sands and leaving them to take care of themselves results only in failure. Where the land is soft and can be marked readily by a wagon track, to aid the planters in distributing the trees rapidly and evenly, their planting can be undertaken at a minimum of expense.

4. The trees that have been recommended for cultivation grow more rapidly and attain dimensions suitable for use sooner than is generally understood. Specimens of white pine ten inches or a foot in diameter, that have been planted only twenty-five years, are not uncommon, and there are well authenticated instances of

the Catalpa having made an average annual increase of an inch in diameter, trees twenty-five years from planting having attained a diameter of two feet. Still it is to be borne in mind that these are cases of exceptionally vigorous growth, and at the best, the planting of trees must be considered a wise and liberal policy for the future, and not a source of immediate gain.

The facts, then, appear to entirely justify the conclusion that it is altogether practicable to rehabilitate the denuded pine regions of Michigan with valuable pine and other timber trees whenever the owners of the land, whether individuals, railroad companies or the State government, are ready to assume the responsibility and expense of the undertaking.

It would seem that the initiative in this great enterprise should be taken by the State. The traditional and distinctive spirit of our National and State institutions favors such intelligent provision for the future, and the example of such a State, in taking timely measures to provide for the future timber supply and instituting suitable experiments for determining the problems of practical forestry that are so soon to be thrust upon us, is a matter of no small moment. The experience of European governments, though in many respects not applicable in our own country, has conclusively established the desirability and necessity of a right position on the part of the government relative to this important interest. It is only through the decided and persistent intervention of the government of France that the fatal consequences of denuding her mountain regions have been in a measure averted, and practical operations of great magnitude and expense, which it is perfectly understood will require scores of years for their accomplishment, have been undertaken for the purpose of reforesting the denuded regions referred to. In the same country an extensive territory along the coast has been converted from drifting sands and unwholesome marshes into valuable forests, from which the government derives a considerable annual revenue, and a large population find their homes and means of living at the mills and other industrial establishments that have grown up there. Prussia is growing trees at a profit on extensive areas of sandy soil, described as being quite as worthless as that of the pine barrens of Michigan, and the government of Norway, with its extensive forests, from which the countries of the Old World have so long drawn immense quantities of lumber, is already purchasing land for the purpose of growing timber.

It is still to be seen whether any such providential measures will be adopted by the State of Michigan, the State that at present has more extensive lumber interests than any other in the Union. Should the subject receive serious attention at the hands of our legislators, there are two things that deserve special consideration—First, the fact that it is possible now, at slight expense, to retain under the direct control of the State, extensive areas of land, valuable for the purposes of forestry, that, so far as can now be seen, are worthless for anything else; second, *the exact facts that we must have in order to determine what to plant on the pine barrens of this State will have to be ascertained by actual experimental planting on those barrens*, and the sooner such experiments are instituted the sooner we may hope for the restoration, in part at least, of the forest wealth of the State.

——:o:——

ORGANIC PHYSICS.

BY CHARLES MORRIS.

(Continued from page 148.)

THE difference in character between different muscles becomes here a matter of importance, since each muscle is thus adapted to its special duty. In the striated voluntary muscles only those fibers respond which are directly acted upon by nerve energy. But their response is rapid and vigorous, so as to produce quick, energetic and localized motions. In the smooth muscles of the intestinal canal irritation yields a less vigorous result. But in them the energy is gradually communicated from fiber to fiber, so that a progressive muscular action arises, yielding the peculiar motion known as peristaltic. In the former case the fibers are energetic, but are insulated. In the latter they are less vigorous, but are in a degree uninsulated. In the muscles of the heart both these conditions exist. Its muscles are of the striped variety, and are very energetic. They are also completely uninsulated. The fibers are destitute, or nearly so, of sarcolemma, and inosculate with each other, so as to form an intricate fibrous network. This seems the most effective of all muscular arrangements for vigorous action. There is not only quick, but general response to every nerve excitation, though brought by but a single fiber. A slight impulse brought to a single muscle fiber is immediately disseminated throughout the heart, causing general